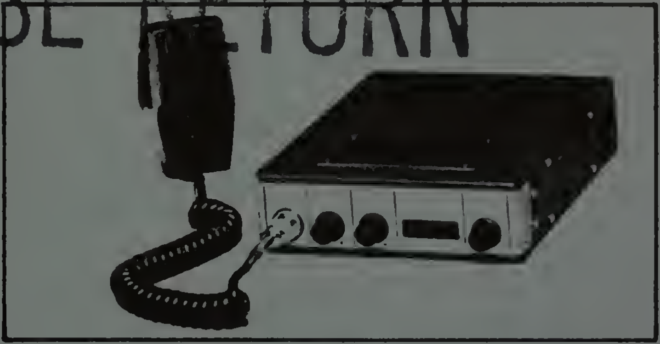
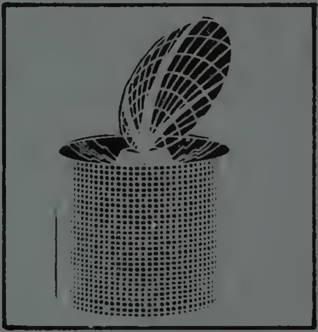
S
384
A31t
1982
Vol.1

TELECOMMUNICATIONS PLAN

82

STATE DOCUMENTS COLLECTION
JAN 27 1983
MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620
PLEASE RETURN





STATE OF MONTANA
DEPARTMENT OF ADMINISTRATION
COMMUNICATIONS DIVISION
NOVEMBER, 1982

JAN 1 1 1984

FEB - 5 1982

MONTANA STATE LIBRARY
S 384 A31t 1982 c.1 v.1
Telecommunications plan '82.
3 0864 00043584 5

JAN 4
JAN 4 1984
FEB 25 1987

PLEASE RETURN

TABLE OF CONTENTS

PAGE

List of Exhibits, Tables and Figures.................... ii

Executive Summary....................................... 1

Introduction.. 2

Telephone Systems....................................... 6

Proposed Statewide Telecommunications Transmission System.. 18

Land Mobile Radio....................................... 36

An Era of Telecommunications Opportunities.............. 47

STATE DOCUMENTS COLLECTION

JAN 27 1983

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

LIST OF EXHIBITS, TABLES AND FIGURES

		PAGE
EXHIBIT 1	Existing Telephone System Switch Information	7
EXHIBIT 2	"Big Four" Local Service and Equipment (CENTREX Costs)	9
EXHIBIT 3	Telephone Costs - "Big Four"	10
EXHIBIT 4	Telephone Costs - Total Increase from FY-76 Through FY-82 - "Big Four"	11
EXHIBIT 5	Tariff Summary: Mountain Bell	12
EXHIBIT 6	Preliminary Analysis of Mountain Bell Requested Rate Increases on State Telecommunications Expenditures	13
EXHIBIT 7	"Big Four" Telecommunications Systems Ten-Year Replacement Cost Comparison	16-17
EXHIBIT 8	Proposed Microwave Transmission System	20
EXHIBIT 9	State Telpak Lines	21
EXHIBIT 10	Intrastate Telecommunications Network - FY-82 Expenditures	30
EXHBIT 11	15-Year Cost Savings for Digital Microwave Plan II	32
EXHIBIT 12	Comparison Projected Costs	33
EXHIBIT 13	CASE I: No TELPAK After 3 Years (1985)	34
EXHIBIT 14	CASE II: No TELPAK After 5 Years (1987)	35
TABLE A	Inventory of Land Mobile Radio Equipment State of Montana and Local Governments	37
TABLE B	JUSTIFICATION: High Band Radio System-Support Document	38
FIGURE 1	Eligibility for Mutual Aid Radio Frequencies in Selected Agency Radios	42

EXECUTIVE SUMMARY

The State of Montana, one of the largest users of telephone services and equipment within the State, must look at telecommunications strategies necessary to deal with the increasing pressures from technical obsolescense, rapidly increasing costs and changes in the telecommunications regulatory environment.

An evaluation of the present Montana State Telephone System stresses the need for the State to implement and proceed with a competitive bid strategy to obtain the most up-to-date and economical telephone service and equipment. The replacement of telephone switches at five of the largest state institutions is part of that direction.

Rising costs of long-distance telephone service and projected growth requirements for voice, data and radio communications led to a study of alternative transmission methods. That study identified a statewide, high speed digital microwave system as the most efficient and cost-effective alternative. Such an alternative would improve the quality of numerous state government applications, extend the State Telephone System to twelve more communities and enable local political subdivisions access to the System.

A land mobile radio plan was prepared. Solutions proposed to problems of interagency communications, and frequency interference and overcrowding include conversion of state and local agencies from low band to high band radio frequencies, and preparation of a frequency utilization plan. Legislation should be proposed to strengthen the State's role and provide for radio user input in frequency utilization.

There is an ongoing need for telecommunications development in order to assure that Montana continues to be prepared for the rapidly evolving communications and information society. Networking for the future will require integrated systems enabling voice and data switching, word processing, electronic filing, data processing, imaging, teleconferencing, facsimile and electronic mail.

Digitized by the Internet Archive
in 2012 with funding from
Montana State Library

http://archive.org/details/telecommunicatio3445mont

INTRODUCTION

INTRODUCTION

Telecommunications means any organization, creation, transmission, emission, storage-retrieval, or reception of signs, signals, writing, images and sounds, or intelligence of any nature, by wire, radio, television, optical or other electro-magnetic systems. The potential for various telecommunications applications has been compared to the use of computers fifteen years ago. That is to say that the State of Montana is standing on the threshold of an era that will attempt to apply a number of new and emerging, cost effective technologies to communication and information needs and services.

In 1981, the Montana Legislature recognized the need for the continuation of comprehensive telecommunications planning at the State level and provided funds for a planning program through HB 827. The Montana telecommunications environment was undergoing analysis prior to the 1981 session through a federally funded study, the Montana Telecommunications Advisory Council (MTAC). In addition to the Legislature's HB 827 and the federal study, the 1981 Legislature established high band radio pilot projects for the Highway Patrol and the Department of Highways. This was funded to provide the opportunity to analyze the relative efficiency and feasibility of large-scale conversion of public safety land mobile radio communications from low band to high band frequency channels.

To achieve the maximum benefit at the least cost from the rapid growth of telecommunications technologies, the Communications Division, Department of Administration, has embarked upon an active program to provide for more efficient operation, effective planning and management of potential and existing telecommunications facilities and equipment.

The changes in the telecommunications industry resulting from the impending divestiture and deregulation of A.T.&T. and the rapidly evolving and improving technologies have forced the Communications Division to take a hard look at the State's current and future utilization of telecommunications systems, services and equipment.

DIVESTITURE AND DEREGULATION

On January 8, 1982, A.T.&T. agreed to a settlement of the seven year old antitrust suit brought by the United States Department of Justice. The settlement, technically a "dismissal by stipulation" of the Federal government's antitrust case and modification of the 1956 Consent Decree which had prevented A.T.&T. from competing in unregulated services, insures that it will be neither as simple nor as cheap to "reach out and touch someone".

After Judge Harold H. Greene issued an opinion providing for some new restrictions on the original agreement, the modified Consent Decree was signed by the Justice Department and A.T.&T. on August 26, 1982. It takes effect within 18 months and requires A.T.&T. to submit reorganization plans to Judge Greene for his approval by February 26, 1983.

Under the terms of the settlement, as amended by Judge Greene, A.T.&T. will divest itself of all 22 of its operating telephone companies, such as Mountain Bell, after 18 months, while retaining Bell Laboratories and Western Electric, its research and development facility and its manufacturing arm. A.T.&T. will also keep its Long Lines Division, which will continue to provide regulated long-distance telephone communications, including the intrastate service presently supplied by the local operating companies.

In exchange for giving up the operating companies, A.T.&T. is permitted for the first time to enter other, non-regulated businesses, such as data processing and office automation. This market entry will be accomplished through A.T.&T.'s newly created and unregulated subsidiary, American Bell, Inc.

One of the key elements of the divestiture plan will be to determine new Local Access and Transport Areas (LATAs) for the divested local operating companies. The LATAs are the areas designated to each local regulated company for providing telephone service. The interexchanges, areas between the LATAs that include intrastate long distance service, will be transferred from the Bell Operating Companies to A.T.&T., where they will be merged with the Long Lines Division.

The partition of the Bell System into a fully tariffed Bell Regulated Entity and a completely unregulated, detariffed Fully Separated Subsidiary (American Bell), scheduled to occur in 1983, means the end of the traditional "Telephone Company", providing complete end-to-end services.

The Bell Regulated Entity, which will include the 22 current Bell Operating Companies, will be fully tariffed and regulated. It will provide dial tone to user premises and charge for usage in a manner similar to the way in which regulated power companies supply electrical current to users and charge for consumption.

The Fully Separated Subsidiary will not be regulated or tariffed. It will provide and service customer premised terminal equipment, including switching systems, inside cable, telephone instruments and data terminals, as well as offer enhanced transmission services which make changes to the information being transmitted.

A direct result of partitioning the Bell System will be erosion of Bell's regulated rate base through the removal of all terminal equipment installed before January 1, 1983. This may cause rapid and dramatic increases in the cost of the regulated dial tone

services provided by the Bell Regulated Entity. These anticipated rate increases could mean the end of Centrex as a viable switching system and of TELPAK (group channel service) as a network transmission vehicle. Centrex switches and TELPAK service are both used for a large percentage of the telecommunications traffic in the State of Montana.

A summary of the effects of the divestiture and deregulation can be found in Appendix A.

NEW TECHNOLOGIES

Concurrently with deregulation, an explosion of new technology is occurring across the whole telecommunications spectrum. These new technological advances offer a wide range of choices for providing a variety of new, enhanced, more cost effective telecommunications systems and services.

Over the past five years, business and governmental communications have seen more advances than during any other period in history. The main reason for all this activity has been the introduction of computer controlled techniques to the business telephone system. These new systems have made any system built without this technology "obsolete". Many companies, including several computer manufacturers, have developed new products and systems to compete in the telecommunications market.

STRATEGIES FOR THE STATE OF MONTANA

The State of Montana, one of the largest users of telephone services and equipment within the State, must look at telecommunication strategies necessary to deal with the increasing pressures from technical obsolescence, rapidly increasing costs and changes in the telecommunications regulatory environment. The Communications Division has responded to this need and developed strategies covering the two major areas of concern in Montana telecommunications: telephone system obsolescence and alternate transmission systems. A third area in need of coordination and management strategy is the land mobile radio communications network.

The overriding strategy is to let the competitive marketplace provide the State with the most cost effective technologies necessary to manage the rapidly rising direct and indirect costs associated with the present regulatory environment in the State of Montana. Using the competitive market, the Communications Division has specifically devised a strategy of analyzing and evaluating current systems and needs, soliciting competitive bids through a detailed Request for Quotation process for replacement of systems where needed, and supervising and coordinating system installation.

The Division has used this strategy to replace the telephone system at Western Montana College in Dillon and award a contract for the replacement of the systems at the Helena, Missoula,

Bozeman and Billings state complexes. The competitive bid process was also used to acquire a system for the new Justice/State Library building in Helena. The study of alternate transmission systems and potential replacement of the existing network is guided by a similar strategy.

To date, the Communications Division has taken a more passive role in land mobile radio system development. The Division's involvement in high band pilot projects, establishing mutual aid frequencies and frequency coordination have been and will continue to be aimed at minimizing the fragmentation in this area of State communications.

CHAPTER I

TELEPHONE SYSTEMS

TELEPHONE SYSTEMS

INTRODUCTION

In 1968, the FCC, in its Carterfone Decision, declared the "telephone company tariff regulations prohibiting the interconnection of customer owned equipment to the public telephone system are invalid." This decision terminated the protected monopoly of the telephone companies, which led to increased competition and made telephone equipment and services available from a multitude of sources. Competition forced all suppliers to make available to the consumer equipment containing the most advanced telephone technology.

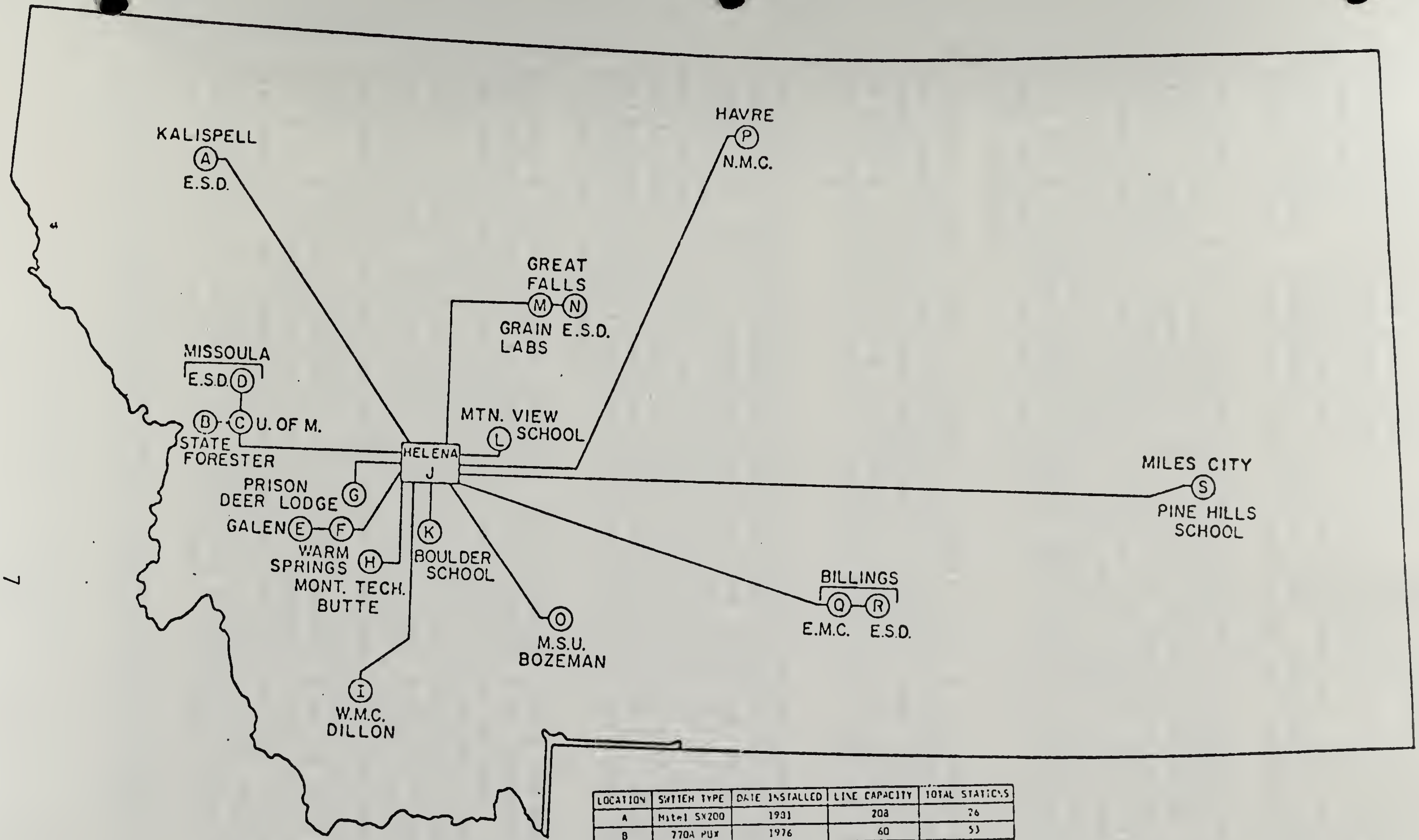
This change has had a significant impact on the State of Montana. Two telephone systems have already been acquired through the competitive bid process and are currently operational at Western Montana College in Dillon and the new Justice/State Library building in Helena. Four other switching systems are to be replaced through the RFQ process at the State complexes in Helena, Bozeman, Missoula and Billings. This section discusses the present State Telephone System and the economic, technical and regulatory reasons why the Communications Division, Department of Administration, has employed the strategy it has for meeting the numerous challenges the State faces in its telephone system environment.

PRESENT SYSTEM

The Montana State Telephone System (MSTS) is a network of 19 telephone switches, including one digital PBX, electro-mechanical PBX systems and Centrex systems, located in several communities throughout the State as Exhibit 1 indicates. With the exception of the digital system at Western Montana College and a small switch in Kalispell, all of the switching equipment is rented from Mountain Bell.

The State of Montana spent over $2.1 million in FY-82 for telephone equipment rental charges (local service and equipment) and could spend as much as $2.8 million in FY-83, depending on the amount of the pending 1982 Mountain Bell tariff request granted by the Public Service Commission.

The MSTS is also comprised of network tie lines, which provide the transmission links between the various communities presently on the network, and WATS service, both interstate (171) and intrastate (151) lines. The Centrex system in Helena acts as the hub for all MSTS traffic by switching tie lines and providing access to WATS facilities. Tie lines to Helena provide MSTS and WATS access. The tie line network and the WATS network will be discussed in more detail later.


KALISPELL
A
E.S.D.
HAVRE
P
N.M.C.
GREAT FALLS
M
N
GRAIN LABS
E.S.D.
MISSOULA
E.S.D.
D
B
C
U. OF M.
STATE FORESTER
MTN. VIEW SCHOOL
L
HELENA
J
MILES CITY
S
PINE HILLS SCHOOL
PRISON DEER LODGE
G
GALEN
E
F
WARM SPRINGS
H
MONT. TECH. BUTTE
K
BOULDER SCHOOL
BILLINGS
Q
R
E.M.C.
E.S.D.
O
M.S.U. BOZEMAN
I
W.M.C. DILLON

LOCATION	SWITCH TYPE	DATE INSTALLED	LINE CAPACITY	TOTAL STATIONS
A	Mitel SX200	1981	208	76
B	770A PBX	1976	60	53
C	NCX23 CTX	1971	3,200	2,684
D	770A PBX	1976	80	37
E	770A PBX	1977	160	109
F	770A PBX	1975	200	264
G	770A PBX	1977	120	136
H	D400 FP4	1980	300	202
I	S-C DBX1200	1982	600	408
I	NTI SL-1	1982	Trunk Sw.	
J	#5 XBAR CTX	1969	2,938	3,678
K	757 PBX	1979	160	197
L	756 PBX	1970	60	32
M	740E PBX	1968	55	54
N	770A PBX	1977	120	52
O	701 CTX	1971	2,940	2,677
P	770A PBX	1977	200	70
Q	701 CTX	1966	1,000	861
R	770A PBX	1972	[illegible]	78
S	770A PBX	1978	100	62

STATE OF MONTANA

EXISTING TELEPHONE SYSTEM SWITCH INFORMATION

EXHIBIT 1

An evaluation of the present MSTS stresses the need for the State to implement and proceed with the competitive bid strategy mentioned in the introduction. There are three major areas of concern that have been and will continue to be addressed by the Communications Division: 1) economics, 2) technical, 3) regulatory. With Centrex systems accounting for more than 80% of the State's telephone service and equipment annual rental expenditures, Centrex service had to be evaluated first.

Centrex is a Bell system offering that provides central office switching for business system users. In effect, the central office switch serves as the Private Branch Exchange (PBX) for the user. Every telephone station is considered to be directly connected to the central office and every telephone receives central office dial tone. This will make Centrex a regulated local dial tone service after deregulation becomes effective. The Bell System predicts that the cost of Centrex service will double shortly after deregulation and triple before the end of this decade.

Centrex costs have already dramatically increased since 1975. For example, the Centrex annual rental charge for the Helena Complex ("service and equipment" costs) has risen from $405,649 in FY-76 to $934,914 in FY-82. Service and equipment (Centrex) cost trends for the four largest users are shown in Exhibits 2, 3, and 4.

This well established trend of rising Centrex costs is not only a result of the technical obsolescence of Centrex but is also a result of Bell's preparation for the pending deregulation of the telephone industry. To prepare for the resulting competitive environment, Bell has begun a strategy to prematurely retire equipment that may be vulnerable to competition once the telephone equipment market is deregulated. This retirement process is facilitated by continually raising the costs for "obsolete" equipment.

Because the State leases equipment from common carriers (primarily Mountain Bell), it is subject to unpredictable cost increases which are difficult to predict or budget. These rental rate increases are approved by either the Montana Public Service Commission (PSC) or the Federal Communications Commission (FCC) in the form of tariffs. Between 1968 and 1979 Mountain Bell requested no tariff increases; however, applications for tariff increases have become much more frequent in Montana since 1979. Three tariff increases have been requested and granted since 1979. A fourth request is still pending with the Montana PSC. If Bell is granted its request, Centrex costs will increase 24% at the Capitol Complex and as much as 39% at the State University locations. An historical summary of the tariff requests is shown in Exhibit 5 while a preliminary analysis of the impact of the pending 1982 request is illustrated in Exhibit 6.

Centrex is also considered an "obsolete" offering from a purely regulatory viewpoint. This means that Centrex will not be

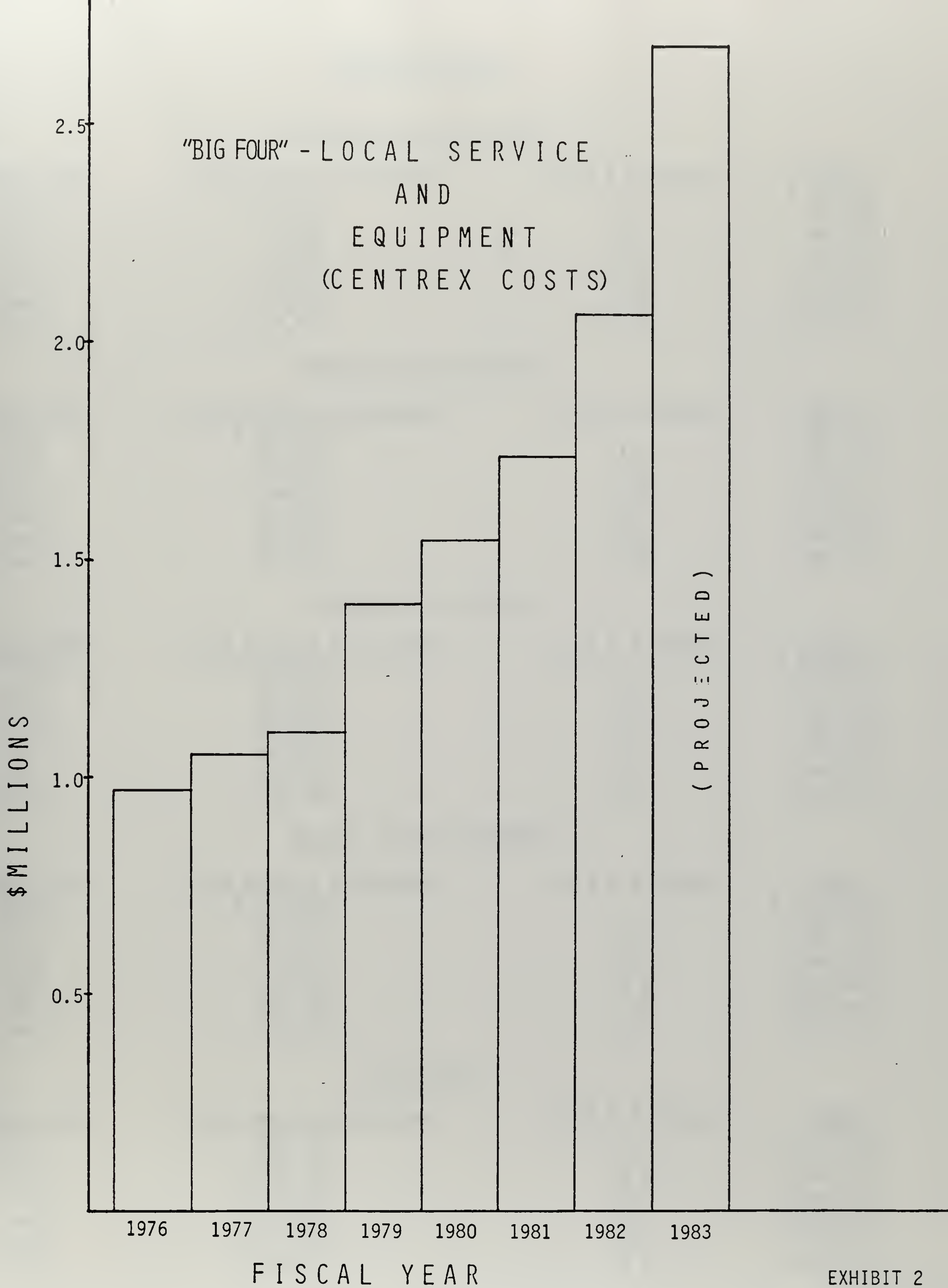

"BIG FOUR" - LOCAL SERVICE
AND
EQUIPMENT
(CENTREX COSTS)
(PROJECTED)
$MILLIONS
2.5
2.0
1.5
1.0
0.5
1976
1977
1978
1979
1980
1981
1982
1983
FISCAL YEAR

EXHIBIT 2

TELEPHONE COSTS

EASTERN MONTANA COLLEGE

Fiscal Year	Local Service & Equipment	LS & E % Change	Total
1976	$ 69,870		$ 91,298
1977	74,221	6.2	90,382
1978	79,458	7.1	88,437
1979	93,918	18.2	107,005
1980	104,843	11.6	114,753
1981	112,408	7.2	115,670
1982	137,654	22.5	169,145

MONTANA STATE UNIVERSITY

Fiscal Year	Local Service & Equipment	LS & E % Change	Total
1976	$ 261,013		$ 365,787
1977	257,306	-1.4	366,454
1978	265,826	3.3	333,673
1979	334,330	25.8	409,431
1980	380,156	13.7	469,425
1981	428,682	12.8	530,528
1982	554,170	29.3	682,114

UNIVERSITY OF MONTANA

Fiscal Year	Local Service & Equipment	LS & E % Change	Total
1976	$ 232,624		$ 316,584
1977	242,301	4.2	312,171
1978	256,006	5.7	324,160
1979	295,821	15.6	354,160
1980	316,919	7.1	372,653
1981	356,946	12.6	393,177
1982	426,198	19.4	461,810

HELENA - STATE GOVERNMENT

Fiscal Year	Local Service & Equipment	LS & E % Change	Total
1976	$ 405,649		$ 972,081
1977	477,701	17.8	1,204,602
1978	497,917	4.2	1,441,802
1979	673,895	35.3	1,595,635
1980	738,100	9.5	1,835,944
1981	833,486	12.9	2,339,547
1982	934,914	12.2	2,645,224

"BIG FOUR"

Fiscal Year	Local Service & Equipment	LS & E % Change	Total
1976	$ 969,156		$ 1,745,750
1977	1,051,529	8.5	1,973,609
1978	1,099,207	4.5	2,188,072
1979	1,397,964	27.2	2,466,231
1980	1,540,018	10.2	2,792,775
1981	1,731,522	12.4	3,378,922
1982	2,052,936	18.6	3,958,293

EXHIBIT 3

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

TELEPHONE COSTS

TOTAL PERCENT INCREASE FROM FY-76 THROUGH FY-82

	Local Service & Equipment Costs	Total Costs
Eastern Montana College :	97%	85%
Montana State University :	112%	86%
University of Montana :	83%	46%
Helena - State Government :	130%	172%
"Big Four" :	112%	127%

EXHIBIT 4

TARIFF SUMMARY: MOUNTAIN BELL

February, 1979 (Passed)	Series PBX increased 20%. First tariff request since 1968. Requested: $11.8 million Granted: $ 3.3 million
August, 1980 (Passed)	No direct impact on PBX systems. Restructure of private line offerings and some terminal equipment. Requested: $16.6 million Granted: $ 6.5 million
October, 1981 (Passed)	Series PBX increased 35% Centrex increased 25% Interim increased of $3 million in April, 1981. Requested: $30.5 million Granted: $13.8 million
February, 1982 (pending)	Requesting: $31 million. Could increase series PBX offerings 25%-40%, Centrex offerings 24%-39%, and Tieline offerings 53%.

EXHIBIT 5

PRELIMINARY ANALYSIS OF MOUNTAIN BELL REQUESTED RATE INCREASES ON STATE TELECOMMUNICATIONS EXPENDITURES

LOCAL SERVICE AND EQUIPMENT

			INCREASE	
	CURRENT$	REQUESTED$	$	%
1. HELENA CAPITOL COMPLEX				
Main Station Lines & Key Equipment*	835,202	1,053,189	217,987	26.1%
Other Local S & E Items	119,775	130,052	10,277	8.5%
Total Local S & E	954,977	1,183,241	228,264	23.9%
2. UNIVERSITY SWITCHING SYSTEMS				
University of Montana:				
Main Station Lines	144,292	264,794	120,502	83.5%
Key Equipment **	85,415	105,658	20,243	23.7%
Other Local S & E Items	220,786	254,857	34,071	15.4%
Total Local S & E	450,493	625,309	174,816	38.8%
3. REMOTE SWITCHING SYSTEMS***				
Billings ESD—Local S & E	12,718	16,251	3,533	27.8%
Great Falls ESD—Local S & E	14,001	19,273	5,272	37.7%
Missoula ESD—Local S & E	11,774	15,787	4,013	34.1%
4. LOCAL ACCESS CHARGES—NON PBX*****				
Less than 5,500 Main Station Lines	–	–	–	48.2%-95.5%
More than 5,500 Main Station Lines	–	–	–	47.6%-107.2%

TIE LINE CHARGES

			INCREASE	
	CURRENT$	REQUESTED$	$	%
State Tie Lines	308,363	472,795	164,432	53.3%
Tie Line End Charges	177,120	252,157	75,037	42.4%
Total Tie Line Charges	485,483	724,952	239,469	49.3%

* There are 235 working key systems in Helena. We randomly sampled 30 key systems and found that the average increase for those systems sampled is 26.1%. Assuming the population is normally distributed, we use the sample results to approximate the affect on the population and are 95% confident that the average annual increase for key systems and main station lines in Helena will be between 23.8% ($198,778) and 28.4% ($237,197).

** There are 97 working key systems at the University of Montana. We randomly sampled 30 key systems and found that the average increase for those systems sampled is 23.7%. Assuming the population is normally distributed, we used the sample results to approximate the affect on the population and are 95% confident that the average annual increase for key systems at the University will be between 22.5% ($19,218) and 24.9% ($21,268).

*** The ESD figures were provided by Mountain Bell.

**** This category includes small State offices that are not a part of the larger Private Branch Exchange (PBX) systems. An example of an office in this category is a local liquor store.

Prepared by the Communications Division
April, 1982

EXHIBIT 6

furnished as a new service to any existing customer or applicant. Additional equipment will be added to existing systems only so long as the existing switching equipment is capable of providing the requested service and the required additional equipment is available from existing or recovered stock.

IMPLEMENTATION OF STRATEGY

During 1979, due to economic and regulatory pressures, the State of Montana began to evaluate ways to control the rising costs of the many telephone systems throughout the State, supplied by Mountain Bell. To assist in this evaluation, Telecommuncations International, Inc. (TII), a Denver-based telecommunications consulting firm, was retained in August, 1981 to conduct a feasibility analysis and needs assessment for the State's telephone systems. This study was conducted under the direction of the State Communications Division of the Department of Administration. The study involved the four largest users of State telephone equipment: the Capitol Complex in Helena; Montana State University in Bozeman; the University of Montana in Missoula; and Eastern Montana College in Bozeman.

In September of 1981 the findings of this study were submitted in a report to the State titled, "State of Montana Telecommunications Feasibility Analysis and Needs Assessment". (See Appendix B). This report contained a recommendation that the State of Montana solicit competitive bids for replacement telephone systems utilizing a detailed Request for Quotation to be circulated throughout the telecommunications marketplace. From both a cost and service viewpoint, it appeared favorable to replace the current, obsolete equipment with newer, more cost effective systems. The recommendation itself was based on an indication of long term cost avoidance potentials as well as the ability to improve services.

System specifications were prepared for each of the four study sites and an RFQ was released in May of 1982 for competitive bidding. By July 23, 1982, the State Purchasing Division had received nine bid responses from the following:

-Datatel, Inc.
-Henkels & McCoy, Inc.
-Northern Telecom, Inc.
-Centel Business Systems
-Mountain Bell
-GTE Telenet Systems
-Rolm Intermountain
-Universal Communications Systems, Inc.
-Telecom Equipment Corp.

The bids for purchase ranged from \$7.2 million to \$12.6 million. The low bid was more than \$2.5 million lower than the original estimate provided by TII. The time lag between September of 1981 and July of 1982 accounts for part of that difference due to the rapidly improving technologies. However, the competitive bid

process is responsible for a significantly larger portion of the difference between the actual low bid price and the 1981 estimated cost.

After each quote was initially checked for compliance with the RFQ's general terms and conditions, a financial, operations and technical evaluation was performed on each bid proposal. Based on the analysis by TII and the Communications Division, the Department of Administration has awarded a bid to Centel Business Systems to provide Northern Telecom SL-1 digital PBX switching systems for the Missoula, Helena, Bozeman and Billings locations.

In addition to replacing obsolete Centrex systems, the new telephone systems will save the State several million dollars. The Department of Administration projects cost savings ranging from $11 million to more than $20 million over the 10 year useful life of the new equipment. Exhibit 7 gives more detailed cost and savings projections.

Prior to the release of the RFQ for the Capitol Complex, MSU, U of M and EMC telephone switching systems, a prototype project was completed at Western Montana College in Dillon. Begun in November of 1981, the telephone system replacement project resulted in a bid and subsequent contract award in February of 1982. Executone Systems of Montana, (now DATATEL), the lowest responsible bidder among six bidding companies, was awarded that contract.

The new Stromberg-Carlson DBX 1200 switching system has been operational at Western Montana College since July, 1982. The college expects to save $450,000 over the life of the 10-year lease. The cost effective, state-of-the-art system provided by DATATEL is technologically compatible with the SL-1 PBX systems to be provided by Centel for the complexes in Helena, Missoula, Bozeman and Billings.

An additional system acquisition project has been completed for the new Justice/State Library building in Helena. The bid and contract were awarded to Mountain Bell for a HORIZON system. Installation began in July, 1982 and is scheduled to be completed in November, 1982.

With the uncertainty surrounding the impending changes in the regulatory environment and the recent dramatic cost increases, the State of Montana has taken important steps in gaining control and reducing a major portion of its telecommunications costs. These steps were made possible through the opportunities offered by the competitive marketplace.

October 6, 1982

STATE OF MONTANA
"BIG FOUR" TELECOMMUNICATION SYSTEMS
TEN-YEAR REPLACEMENT COST COMPARISON

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
EASTERN MONTANA COLLEGE											
Centel Equipment	$142,062	$142,062	$142,062	$142,062	$142,062	$142,062	$142,062	$142,062	$142,062	$142,062	$1,420,620
Centel Maintenance		24,000	26,640	29,570	32,823	36,434	40,441	44,889	49,829	55,309	339,935
Access Charges	43,992	48,831	54,203	60,165	66,783	74,129	82,283	91,334	101,381	112,533	735,634
TOTAL	186,054	214,893	222,905	231,797	241,668	252,625	264,786	278,285	293,272	309,904	2,496,189
Centrex @ 50% of Request	171,414	190,270	211,199	234,431	260,219	288,843	320,615	355,883	395,030	438,483	2,866,387
Estimated Savings	$(14,640)	$(24,623)	$(11,706)	$ 2,634	$ 18,551	$ 36,218	$ 55,829	$ 77,598	$101,758	$128,579	$ 370,198
Centrex @ 100% of Request	196,944	218,608	242,655	269,347	298,975	331,862	368,367	408,887	453,865	503,790	3,293,300
Estimated Savings	$ 10,890	$ 3,715	$ 19,750	$ 37,550	$ 57,307	$ 79,237	$103,581	$130,602	$160,593	$193,886	$ 797,111
MONTANA STATE UNIVERSITY											
Centel Equipment	$453,173	$453,173	$453,173	$453,173	$453,173	$453,173	$453,173	$453,173	$453,173	$453,173	$4,531,730
Cental Maintenance		90,840	100,832	111,924	124,236	137,902	153,671	169,908	188,598	209,344	1,287,255
Access Charges	189,492	210,336	233,473	259,155	287,662	319,305	354,428	393,416	436,691	484,727	3,168,685
TOTAL	642,665	754,349	787,478	824,252	865,071	910,380	961,272	1,016,497	1,078,462	1,147,244	8,987,670
Centrex @ 50% of Request	667,314	740,719	822,198	912,639	1,013,030	1,124,463	1,248,154	1,385,451	1,537,850	1,707,014	11,158,832
Estimated Savings	$ 24,649	$(13,630)	$ 34,720	$ 88,387	$147,959	$214,083	$286,882	$368,954	$459,388	$559,770	$2,171,162
Centrex @ 100% of Request	747,180	829,370	920,600	1,021,867	1,134,272	1,259,042	1,397,536	1,551,265	1,721,904	1,911,314	12,494,350
	$104,515	$ 75,021	$133,122	$197,615	$269,201	$348,662	$436,264	$534,768	$643,442	$764,070	$3,506,680
UNIVERSITY OF MONTANA											
Centel Equipment	$337,486	$337,486	$337,486	$337,486	$337,486	$337,486	$337,486	$337,486	$337,486	$337,486	$3,374,860
Centel Maintenance		65,203	72,381	80,343	89,180	98,990	109,879	121,966	135,382	150,274	923,598
Access Charges	133,032	147,666	163,909	181,939	201,952	224,167	248,825	276,196	306,578	340,301	2,224,565
TOTAL	470,518	550,355	573,776	599,768	628,618	660,643	696,190	735,648	779,446	828,061	6,523,023
Centrex @ 50% of Request	535,230	594,105	659,457	731,997	812,517	901,894	1,001,102	1,111,223	1,233,458	1,369,138	8,950,121
Estimated Savings	$ 64,712	$ 43,750	$ 85,681	$132,229	$183,899	$241,251	$304,912	$375,575	$454,012	$541,077	$2,427,098
Centrex @ 100% of Request	618,504	686,539	762,059	845,885	938,933	1,042,215	1,156,859	1,284,113	1,425,366	1,582,156	10,342,629
Estimated Savings	$147,986	$136,184	$188,283	$246,117	$310,315	$381,572	$460,669	$548,465	$645,920	$754,095	$3,819,606

Page 1

EXHIBIT 7

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
MISSOULA STATE FORESTER											
Centel Equipment	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 15,453	$ 154,530
Centel Maintenance		1,680	1,865	2,070	2,298	2,550	2,831	3,142	3,488	3,872	23,796
Access Charges	3,828	4,249	4,716	5,235	5,810	6,450	7,159	7,947	8,821	9,791	64,006
TOTAL	19,281	21,382	22,034	22,758	23,561	24,453	25,443	26,542	27,762	29,116	242,332
Centrex @ 50% of Request	17,700	19,647	21,808	24,207	26,869	29,825	33,106	36,748	40,790	45,277	295,977
Estimated Savings	$(1,581)	$(1,735)	$(226)	$ 1,449	$ 3,308	$ 5,372	$ 7,663	$ 10,206	$ 13,028	$ 16,161	$ 53,645
Centrex @ 100% of Request	20,244	22,471	24,943	27,686	30,732	34,112	37,965	42,030	46,653	51,785	338,621
Estimated Savings	$ 963	$ 1,089	$ 2,909	$ 4,928	$ 7,171	$ 9,659	$ 12,522	$ 15,488	$ 18,891	$ 22,669	$ 96,289
HELENA CAPITOL COMPLEX											
Centel Equipment	$389,604	$389,604	$389,604	$389,604	$389,604	$389,604	$389,604	$389,604	$389,604	$389,604	$3,896,040
Centel Maintenance		78,120	86,713	96,252	106,840	118,592	131,637	146,117	162,190	180,030	1,106,491
Access Charges	210,780	233,966	259,702	288,269	319,979	355,176	394,246	437,613	485,750	539,183	3,524,664
TOTAL	600,384	701,690	736,019	774,125	816,423	863,372	915,487	973,334	1,037,544	1,108,817	8,527,195
Centrex @ 50% of Request	1,089,036	1,208,830	1,341,801	1,489,399	1,653,233	1,835,089	2,036,949	2,261,013	2,509,725	2,785,794	18,210,869
Estimated Savings	$ 488,652	$ 507,140	$ 605,782	$ 715,274	$ 836,810	$ 971,717	$1,121,462	$1,287,679	$1,472,181	$1,676,977	$9,683,674
Centrex @ 100% of Request	1,222,176	1,356,615	1,505,843	1,671,486	1,855,349	2,059,437	2,285.975	2,537,433	2,816,550	3,126,371	20,437,235
Estimated Savings	$ 621,792	$ 654,925	$ 769,824	$ 897,361	$1,038,926	$1,196,065	$1,370,488	$1,564,099	$1,779,006	$2,017,554	$11,910,040
TOTAL "BIG FOUR" LOCATIONS											
Centel Equipment	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$1,337,778	$13,377,780
Centel Maintenance		259,843	288,431	320,159	355,377	394,468	438,459	486,022	539,487	598,829	3,681,075
Access Charges	581,124	645,048	716,003	794,763	882,186	979,227	1,086,941	1,206,506	1,339,221	1,486,535	9,717,554
TOTAL	1,918,902	2,242,669	2,342,212	2,452,700	2,575,341	2,711,473	2,863,178	3,030,306	3,216,486	3,423,142	26,776,409
Centrex @ 50% of Request	2,480,694	2,753,571	3,056,463	3,392,673	3,765,868	4,180,114	4,639,926	5,150,318	5,716,853	6,345,706	41,482,186
Estimated Savings	$ 561,792	$ 510,902	$ 714,251	$ 939,973	$1,190,527	$1,468,641	$1,776,748	$2,120,012	$2,500,367	$2,922,564	$14,705,777
Centrex @ 100% of Request	2,805,048	3,113,603	3,456,100	3,836,271	4,258,261	4,726,668	5,246,702	5,823,728	6,464,338	7,175,416	46,906,135
Estimated Savings	$ 886,146	$ 870,934	$1,113,888	$1,383,571	$1,682,920	$2,015,195	$2,383,524	$2,793,422	$3,247,852	$3,752,274	$20,129,726

EXHIBIT 7

CHAPTER II

NETWORK TRANSMISSION SYSTEM ALTERNATIVES

PROPOSED STATEWIDE TELECOMMUNICATIONS TRANSMISSION SYSTEM

INTRODUCTION

Rising costs of long-distance telephone service and projected growth requirements for voice, data and land mobile radio communications led the Communications Division to a study of alternative transmission methods. The present low rates for groups of telephone circuits leased from Mountain Bell (TELPAK) are expected to increase sharply. The tariff governing TELPAK has "grandfathered" these circuits. This means that the system cannot be extended to other communities at low rates, nor can more volume be added to the system to accomodate future growth. The alternative is much higher-cost conventional line rental. "Grandfathering" has occurred in Idaho and Wyoming as well. It is likely that a tariff will be filed to eliminate TELPAK in the near future. This has occurred in Colorado and New Mexico.

In order to plan ahead for increasing rates and the eventual elimination of TELPAK, Associated P & C Engineers, a Billings-based firm, was employed in June, 1982, by the Communications Division, to identify technologies and costs for an alternative to the present telephone lines leased from common carriers. The study (found in Appendix C) includes four major topics:

a. Analyzed historical data and projected requirements for communications circuits for the State from 1982 to 1997.

b. Analyzed microwave, fiber optic cable, and satellite technologies.

c. Provides for statewide transmission of voice, data and land/mobile radio.

d. Provides access for local governments to the State Telephone System (as required by 2-17-302(g) MCA).

CONCLUSION

The State of Montana's telecommunications requirements are expected to grow considerably in the future, primarily due to the advantages offered by improved electronic communications between people and the exploding data processing environment. In order to meet these projected increases, a state-owned transmission system would offer several important advantages compared to the present system. First, a state network to the east and northeast regions of the state would be offered. This would increase the utility for all state users. Secondly, the state would have increased control over its communications costs and system configuration. Third, data transmission speed and quality would be greatly improved. This feature will be of increasing

importance as future data transmission needs are implemented. Fourth, the possibility of other government entities using, and therefore supporting the system, would offer increased utility to many users and overall cost advantages.

Refer to Exhibit 8 for proposed microwave transmission system.

PRESENT SYSTEM DESCRIPTION

A. TELPAK

1. The Communications Division currently manages a voice/data network centralized in Helena, which interconnects the following communities:

COMMUNITIES	ACCESS CODE
Missoula	125
Billings	122
Boulder	128
Butte	123
Deer Lodge	127
Warm Springs/Galen	129
Warm Springs/Anaconda	129
Dillon	134
Bozeman	126
Great Falls	124
Lewistown	(Data only)
Havre	135
Kalispell	136
Miles City	133

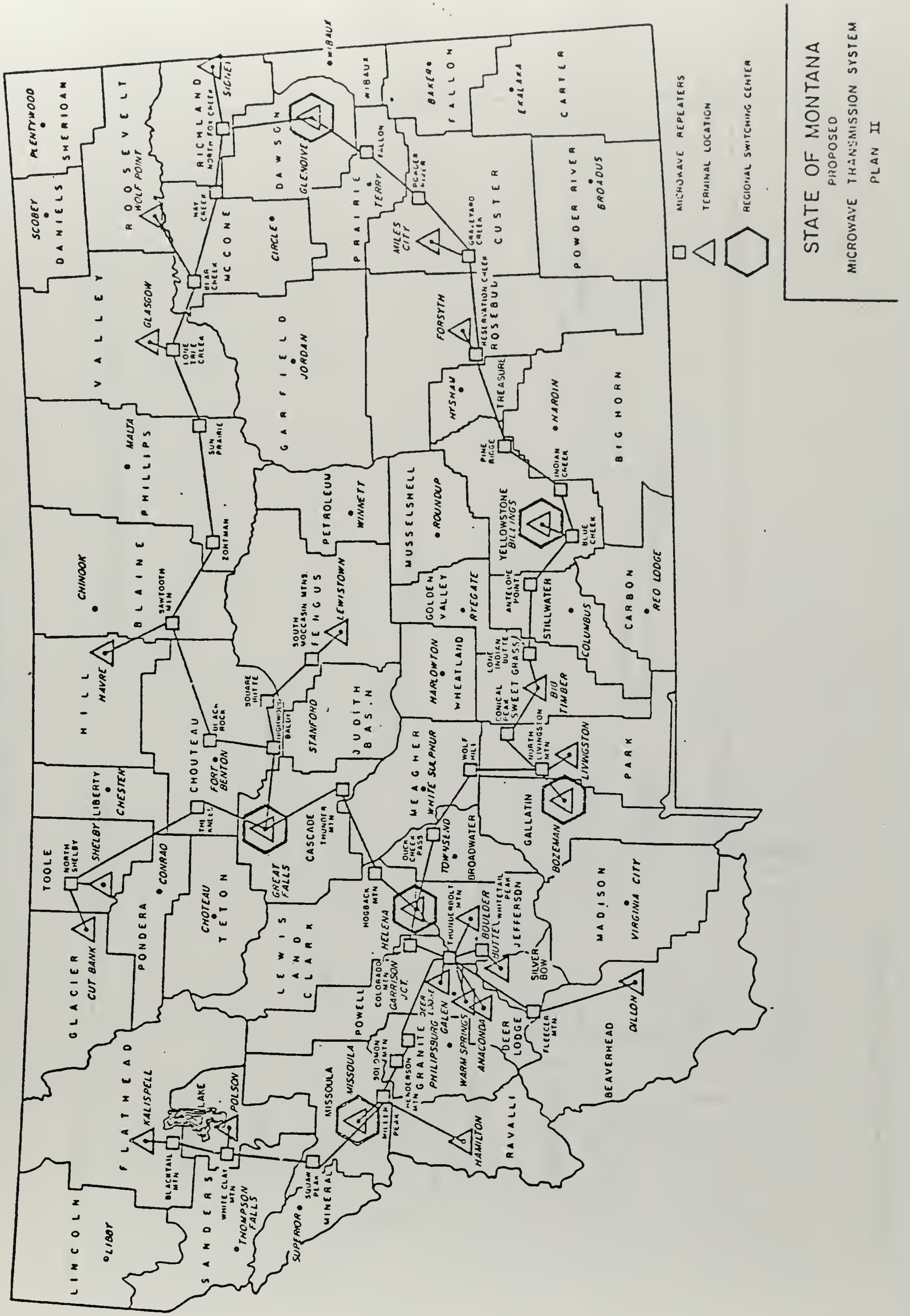
2. The State leases channels (circuits) which extend from Helena to terminate in those towns listed above.

3. The State pays TELPAK rates for the channels to those communities based on air mileage and number of channels. There are 4 groups of channels available to the State:

    -12 channel groups at $17.82 per mile
    -24 channel groups at $23.76 per mile
    -60 channel groups at $29.70 per mile
    -240 channel groups at $53.46 per mile

4. The attached map shows the TELPAK routing currently in place which determines the rates the State pays each month for service to the communities on its TELPAK network. (See Exhibit 9).

5. The following lists the current monthly TELPAK circuit costs of each routing configuration based on current tariffs:

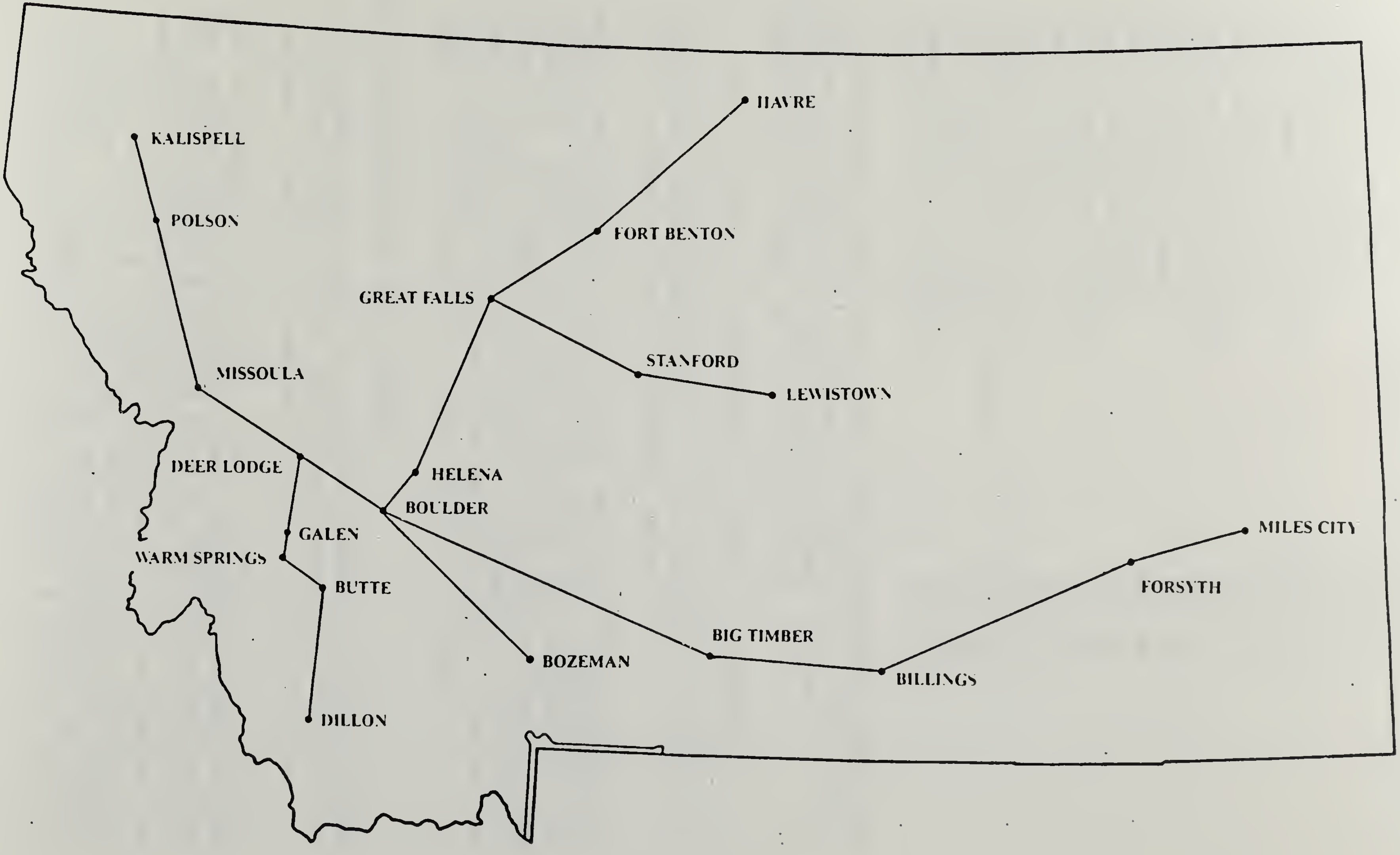


STATE OF MONTANA
PROPOSED
MICROWAVE TRANSMISSION SYSTEM
PLAN II

MICROWAVE REPEATERS
TERMINAL LOCATION
REGIONAL SWITCHING CENTER
LINCOLN
LIBBY
FLATHEAD
KALISPELL
GLACIER
CUT BANK
TOOLE
SHELBY
LIBERTY
CHESTER
HILL
HAVRE
CHINOOK
BLAINE
PHILLIPS
MALTA
VALLEY
GLASGOW
DANIELS
SCOBEY
SHERIDAN
PLENTYWOOD
ROOSEVELT
WOLF POINT
RICHLAND
NORTH FOX CREEK
SIDNEY
WIBAUX
DAWSON
GLENDIVE
MC CONE
CIRCLE
PRAIRIE
TERRY
FALLON
BAKER
CARTER
EKALAKA
CUSTER
MILES CITY
POWDER RIVER
BROADUS
ROSEBUD
FORSYTH
TREASURE
HYSHAM
BIG HORN
HARDIN
GARFIELD
JORDAN
PETROLEUM
WINNETT
MUSSELSHELL
ROUNDUP
YELLOWSTONE
BILLINGS
CARBON
RED LODGE
STILLWATER
COLUMBUS
GOLDEN VALLEY
RYEGATE
WHEATLAND
HARLOWTON
SWEET GRASS
BIG TIMBER
PARK
LIVINGSTON
GALLATIN
BOZEMAN
MADISON
VIRGINIA CITY
BEAVERHEAD
DILLON
SILVER BOW
BUTTE
JEFFERSON
BOULDER
BROADWATER
TOWNSEND
MEAGHER
WHITE SULPHUR
JUDITH BASIN
STANFORD
FERGUS
LEWISTOWN
CASCADE
GREAT FALLS
CHOUTEAU
FORT BENTON
PONDERA
CONRAD
TETON
CHOTEAU
LEWIS AND CLARK
HELENA
POWELL
GARRISON JCT.
DEER LODGE
ANACONDA
WARM SPRINGS
GALEN
GRANITE
PHILIPSBURG
MISSOULA
RAVALLI
HAMILTON
MINERAL
SUPERIOR
SANDERS
THOMPSON FALLS
LAKE
POLSON
BLACKTAIL MTN
WHITE CLAY MTN
SQUAW PEAK
MILLER PEAK
HENDERSON MTN
SOLOMON MTN
COLORADO MTN
HOGBACK MTN
THUNDERBOLT MTN
WHITETAIL PEAK
FLEECER MTN
DUCK CREEK PASS
THUNDER MTN
WOLF HILL
NORTH LIVINGSTON MTN
CONICAL PEAK
LONE INDIAN BUTTE
ANTELOPE POINT
BLUE CREEK
INDIAN CREEK
PINE RIDGE
RESERVATION CREEK
GRAVEYARD CREEK
POWDER RIVER
SOUTH MOCCASIN MTNS.
SQUARE BUTTE
HIGHWOOD BALDY
BLACK ROCK
SAWTOOTH MTN
ZORTMAN
SUN PRAIRIE
LONE TREE CREEK
BEAR CREEK
MAY CREEK
NORTH SHELBY

EXHIBIT 8

STATE TELPAK LINES



HAVRE
KALISPELL
POLSON
FORT BENTON
GREAT FALLS
STANFORD
MISSOULA
LEWISTOWN
DEER LODGE
HELENA
BOULDER
GALEN
WARM SPRINGS
BUTTE
MILES CITY
FORSYTH
BIG TIMBER
BOZEMAN
BILLINGS
DILLON

Prepared by Communications Division, April, 1982

EXHIBIT 9

ROUTE	MONTHLY COST
-Helena to Boulder	$1,389.96
-Boulder to Bozeman	1,930.50
-Boulder to Big Timber	3,207.60
-Big Timber to Billings	2,709.00
-Billings to Forsyth	2,280.96
-Forsyth to Miles City	974.16
-Boulder to Deer Lodge	1,710.72
-Deer Lodge to Missoula	2,049.30
-Missoula to Polson	1,378.08
-Polson to Kalispell	855.86
-Deer Lodge to Galen	475.20
-Galen to Warm Springs	118.80
-Warm Springs to Butte	564.30
-Butte to Dillon	980.10
-Helena to Great Falls	2,138.40
-Great Falls to Fort Benton	659.34
-Fort Benton to Havre	1,229.58
-Great Falls to Stanford	997.92
-Stanford to Lewistown	677.16

6. To illustrate how these costs are determined, the Deer Lodge to Missoula route is analyzed. The State currently leases a 60 TELPAK channel group for that route which covers 69 air miles. Thus:

   69 air miles x $29.70 per air mile = $2,049.30

7. The total TELPAK monthly bill is currently $25,696.94, which is approximately $308,365 annually.

8. Note that the costs are based only on the 4 groups of channels offered and not on how many channels are actually used from one location to another. For example, the State is leasing a 60-channel group from Deer Lodge to Missoula but is actually using 53 of those channels. However, the monthly cost remains the same for this portion of the TELPAK charges.

B. Channel Termination or End Charges

1. To communicate over the TELPAK channels (either voice or data), the State must pay channel termination charges. These are commonly known as end charges.

2. The end charges for each channel termination location are a function of Mountain Bell tariffed rates for the hardware required at the ends of each channel and the number of channels needed to link Helena to the towns on the existing TELPAK network. For example, we currently use 28 TELPAK channels tying Helena to Billings. These circuits have related end charges amounting to $86.78 per line (channel) which creates a total monthly cost of $2,429.84 for end charges

connecting Helena to Billings through 28 TELPAK channels. The State's monthly end charges are:

CITY	# CHANNELS	COST/CHANNEL	MONTHLY TOTAL
Miles City	11	$81.78	$ 899.58
Havre	9	81.78	736.02
Lewistown	7	34.80	243.60
Kalispell	10	66.78	667.80
Butte	19	81.78	1,553.82
Warm Springs/ Galen	2	30.00	60.00
Warm Springs/ Anaconda	8	81.78	654.24
Dillon	5	81.78	408.90
Billings	28	86.78	2,429.84
Deer Lodge	7	81.78	572.46
Boulder	5	81.78	408.90
Missoula	33	86.78	2,863.74
Bozeman	26	86.78	2,256.28
Great Falls	20	81.78	1,635.60

C. Interexchange Channels (IXC)

1. Although most of the State communication channels are covered under the TELPAK tariff some channels to towns like Wolf Point, Hamilton, Glendive, and Livingston are governed by IXC rates.

2. Most of these channels are presently data channels for the LETS network, for the Highway Department's remote dial-up locations, for the Revenue Department's dedicated lines and Computer Services Division (CSD) data lines. The Department of Institutions and Eastern Montana College use some voice-grade channels covered under IXC rates.

3. IXC rates are a function of distance. The first 100 miles are charged at $2.51 per mile per IXC, the next 200 miles cost $1.63 per mile per channel, each additional mile in excess of 300 is set at $1.38 per mile per channel.

D. Intrastate WATS ("151" Access)

1. The State currently leases 33 Intrastate WATS lines which provide us access to those Montana communities not on the TELPAK voice network.

2. The existing WATS rates are tariffed at $790 per line per month. The total monthly intrastate WATS bill is currently $29,230.

3. Based on analysis of intrastate WATS traffic, approximately 37% of the current WATS traffic is to communities proposed to be added to the existing network.

E. Toll Calls

1. When the TELPAK network is not available and users do not have access to WATS lines then they can use Direct Distance Dialing, credit card calls, collect, third party calls, or wait until the network is available. Grouped together these kinds of calls are referred to as toll calls.

2. The current average monthly toll call bill is $17,500. It has been conservatively estimated that 16% of that bill could be eliminated by the proposed network.

IMPACT OF PENDING RATE REQUEST

A. TELPAK

1. The following shows the impact of Bell's pending rate request:

-Monthly TELPAK costs:

CHANNEL GROUP	CURRENT	50% OF THE REQUESTED RATE INC	100% OF THE REQUESTED RATE INC
12	$17.82	$22.57	$27.32
24	23.76	30.10	36.43
60	29.70	37.62	45.54
240	53.46	67.72	81.97

2. An example of the cost impact can be demonstrated using the Big Timber to Billings TELPAK route, a 60 channel group, 70 mile route. Assuming Bell gets 50% of their rate request, this route would cost $2,633.40 per month (70 x $37.62), an increase of $554.40 over the current $2,079.00. This would amount to an annual increase of $6,652.80 for this particular route.

B. End Charges

1. As noted earlier, end charges are in part determined by the actual equipment needed to allow the network to function properly.

2. The following shows the impact of the pending Mountain Bell rate request:

Monthly Costs Per Channel:

CURRENT	50% OF THE REQUESTED RATE INCREASE	100% OF THE REQUESTED RATE INCREASE
$34.80	$ 44.08	$ 53.36
81.78	97.80	113.82
86.78	103.30	119.82

3. To project the full impact of a rate increase the estimated future circuit growth to each locality on the existing network must be incorporated into the model. For example, we presently use 28 channels from Helena to Billings with monthly end charges totaling $2,429.84. Our circuit growth analysis estimates a need for 31 channels in 1983. Thus, if Bell is granted 50% of the requested increase, Billings monthly end charges would increase next year from $2,429.84 to $3,202.30 (31 x $103.30). This would correspond to an annual increase of $9,270.

C. IXC

1. There are no pending IXC rate increases in Mountain Bell's 1982 rate request.

2. IXC rates are currently 3 times higher than current comparable TELPAK rates. As TELPAK rates approach IXC rates, the advantage of using bulk channel service is reduced.

D. Intrastate WATS "151"

1. The pending tariff request will change WATS rates from a fixed rate per line to a measured rate basis:

USAGE	CHARGE
0-15 hours	$15.00 per hour
15.1-40 hours	13.50 per hour
40.1-80 hours	12.00 per hour
80.1-140 hours	10.50 per hour
140.1-220 hours	9.00 per hour
over 220 hours	7.00 per hour

2. In addition to the proposed rate schedule above, Bell will charge $30 per WATS line for access charges (similar to end charges in the TELPAK system). The present flat rate of $790 includes this access charge.

3. Any WATS usage in excess of 60 hours per line per month will cost more on the proposed measured basis than the current fixed rate.

E. Toll Calls

Charges for credit card, collect and third party calls will increase 33% if Mountain Bell is granted 100% of its rate request. The current average monthly toll call bill would then increase from $17,500 to $23,275 resulting in an annual increase of approximately $69,000.

F. Total Impact of Proposed Rate Increase on Present Network Costs

	CURRENT ANNUAL	100% OF REQUEST	%INCREASE
TELPAK CHANNELS	$308,365	$472,826	53.3%
TELPAK END CHARGES	184,689	270,112	46.3%
INTRASTATE WATS	350,760	FIXED RATE TO MEASURED RATE BASIS	
DEDICATED LINES (IXC)	158,020	NO CHANGE	
TOLL CALLS	205,244	273,768	33.3%

SUMMARY OF PROBLEMS WITH PRESENT SYSTEM

A. A significant possibility exists that current discount services will be eliminated in the near future.

B. The pending rate requests are forewarnings of higher costs of transmission in the future.

C. The number of available TELPAK channels is "frozen" with no expansion possible. Some channel routes, like Great Falls to Havre, are already at capacity and the demand is increasing, particularly for data circuits. Unless alternate transmission systems are analyzed and implemented, the State could be forced to use IXC's which are 3 times more expensive than TELPAK. A State-owned network would provide increased flexibility in extending service to communities already on the current network and to those which are not.

PRESENT AND FUTURE COMMUNICATIONS REQUIREMENTS

A system is required which enables low-cost telephone service with sufficient capacity to fulfill present and future needs of state government as well as enable use by local governments. The system should be versatile, enabling high-speed data traffic and land mobile radio control features, and it should provide statewide coverage. Teleconferencing, electronic mail, and heavy increases in data traffic are expected to require greater capabilities than the present system will economically and technically support.

TECHNOLOGIES STUDIED

The three most modern transmission technologies available are microwave radio, fiber optic cable, and satellite. While fiber optics and satellite are increasingly improving and costing less, microwave is recommended because of lower projected costs and higher reliability. The proposed system is capable of expansion to meet future needs and is completely compatible with the new digital electronic switches planned for Helena, Bozeman, Billings, and Missoula, and installed at Dillon.

ALTERNATE TRANSMISSION SYSTEM FEATURES

The proposal expands the State Telephone System from 15 to 27 communities (see Exhibit 8). The high speed digital feature enables data to be transmitted to more locations at almost six times the present speeds. According to the Data Processing Coordinator, Office of Budget and Program Planning, the proposed system would be "highly beneficial to the data processing community". Some of the applications of high speed data transmission will include:

- Extension of the Law Enforcement Network System at high data speeds and to more communities.
- Expansion of community information network, such as AGNET and State Library systems.
- Improved communication of data such as unemployment claims, drivers license registrations, county tax data and other applications where high speed communications between offices of state agencies is required.
- Access by local political subdivisions to intrastate data communications.

In a recent letter, the Flathead County Data Processing Manager said, "Flathead and Missoula Counties have discussed the merits of connecting our two Burroughs B1000 series computers together to share various application programs and to provide service and emergency back-up to each other. Other smaller counties are also becoming interested in utilizing one or both of our installations for computer servicing. We are also interested in working toward long range solutions to moving data between our installations and the State of Montana, at Helena".

Land mobile radio communications can be managed on a statewide basis through implementation of the proposed system. Microwave radio locations serve as links which can be centrally controlled to enable statewide or regional dispatching or radio communications of all kinds. Communication from base stations can be greatly improved for the Montana Highway Patrol and Department of Highways. Other agencies will, for the first time, be able to dispatch their personnel from a central location: brand inspectors, game wardens, revenue agents, etc.

Concern for statewide communications has been expressed by the Board of Crime Control: "If the State of Montana, its political subdivisions, and criminal justice agencies especially are to develop cost-effective, efficient, compatible communications systems for the rapid exchange of information...the Department of Administration...shall proceed to establish, implement, and maintain a state-wide centrally managed telecommunications network capable of accommodating digital, land mobile, telephony, data and text transmissions".

Similarly, the Montana Sheriffs and Peace Officers Association and the Montana Association of Chiefs of Police supported "the implementation of a state-wide land mobile communications system".

Telephone access will be economically provided, enabling greater use of telephone conferencing and reducing the need for intrastate travel. Accomplishing this will require organizational management, but the system will be in place to enable use of modern teleconferencing techniques.

Overall, reliability and expansion, such as for videoconferencing and increased data usage, are built in to the proposed system. Local governments at any system location may obtain access and other communities may also join the system if they so desire.

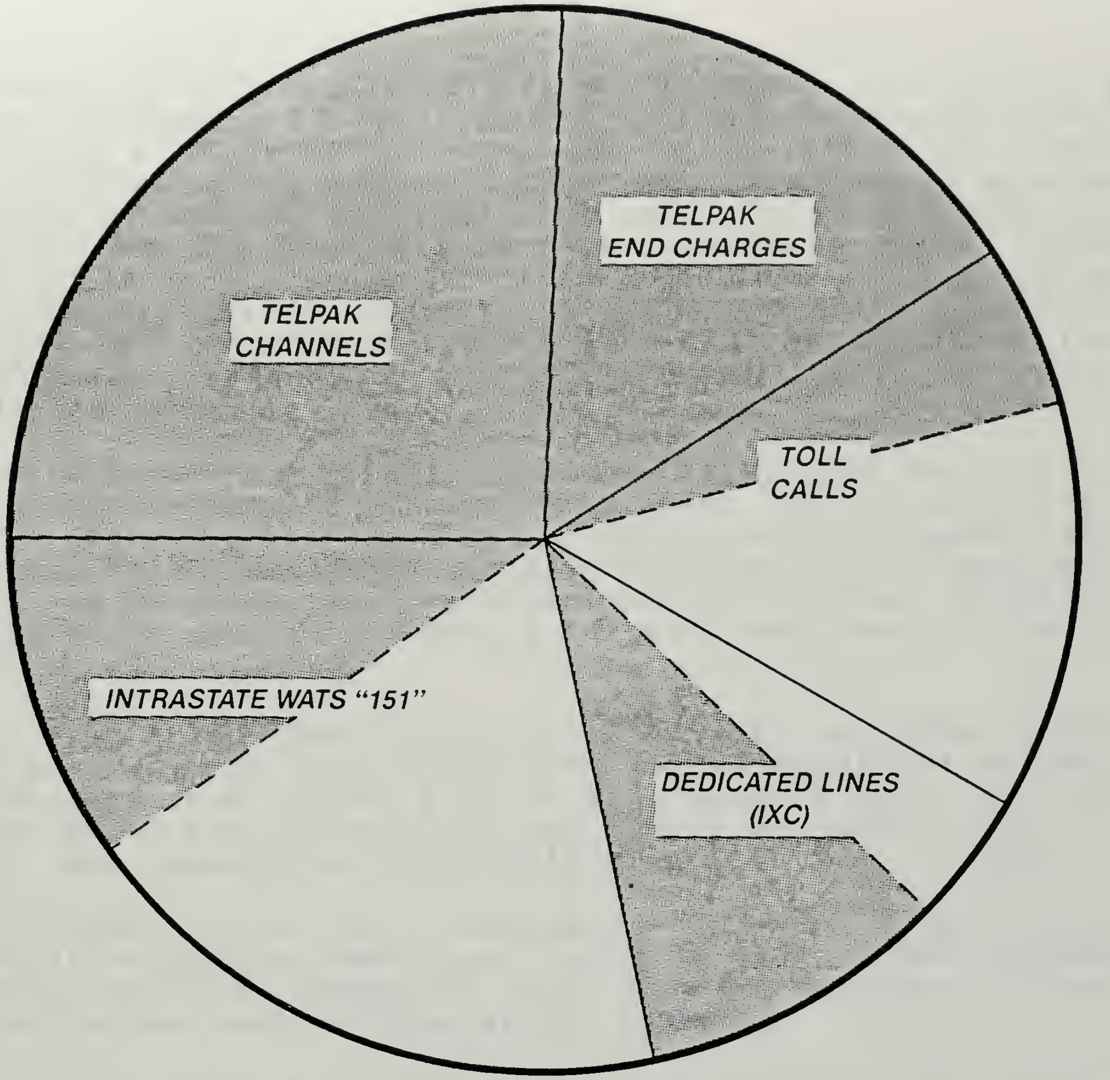
COSTS

The proposed digital microwave transmission system is estimated at a "worst case" cost of $13,112,000. According to Associated Engineers and the Communications Division's most recent experience with the competitive bid process, the nature of the marketplace should reduce the highest possible cost by a minimum of 10%. Thus, a figure of $11,800,000 was used in the cost analysis.

Microwave equipment has an average useful economic life of 20 years. To calculate conservative estimates of cost avoidance, circuit (channel) requirement projections for each community on the existing network were computed for the next 15 years. These circuit projections were calculated using regression analysis which is a method of analyzing trends based on historical data.

To proceed with a cost analysis, one should first look at the percentage of total present cost avoidance represented by: TELPAK channel rates, end charges, IXC rates, intrastate WATS costs and toll call costs. Exhibit 10 provides a graphic illustration of these percentages.

Due to the circuit requirement projections being different for each community and the differences in determining rates, the present costs being analyzed cannot be projected by simply adding an inflation factor each year. An illustration of how some of the projected costs were computed should prove helpful at this



STATE OF MONTANA
INTRASTATE TELECOMMUNICATIONS NETWORK
FY-82 EXPENDITURES

CATEGORY	AMOUNT	% OF TOTAL	AMOUNT ELIMINATED BY PROPOSED NETWORK	% ELIMINATED
TELPAK CHANNELS	$ 308,365	26%	$ 308,365	100%
TELPAK END CHARGES	184,689	15%	184,689	100%
TOLL CALLS	205,244	17%	60,000	29%
INTRASTATE WATS "151"	350,760	29%	128,550	37%
DEDICATED LINES (IXC)	158,020	13%	112,550	71%
$ TOTALS	1,207,078		794,154 (66% OF CURRENT TOTAL)	

EXHIBIT 10

NOTE: SHADED AREAS REPRESENT IMPACT OF PROPOSED NETWORK

point.

First, assume that Mountain Bell is not granted a rate increase this year. Secondly, analyze the Deer Lodge to Missoula TELPAK route. Using a 10% inflation rate, the TELPAK cost is projected by simply inflating the present annual cost ($24,592) to provide an estimate of $27,051 one year from now. To compute the end charges, inflate the base monthly rate ($86.78) to $95.46. Then multiply $95.46 by the projected circuit requirement of 37 which equals a monthly cost of $3,532. This would predict an annual cost of $42,384, which is $15,333 higher than normal inflation would project. The remaining IXC, WATS and toll call costs were inflated annually.

If Mountain Bell is granted a rate increase, cost projection methods would be changed for the first year. The present rates were first increased by 100%, 75% and 50% of the rate request and then applied to the projected circuit requirements for the first year. The methodology used mentioned in the previous paragraph was employed to provide estimates for the remainder of the 15 year period.

Because it is likely that TELPAK will not be available to the State at some time in the near future, two cases were analyzed. Case I assumes that TELPAK will be gone after 3 years and IXC will have to be substituted for the TELPAK channels. Case II makes the same assumption with TELPAK eliminated after 5 years.

Exhibit 11 shows 15 year cost avoidance figures assuming that 15 year general obligation bonds were issued in 1984. These figures include maintenance, principal and interest payments on the debt. Maintenance was inflated at 10% annually.

Exhibits 12, 13, and 14 show the costs associated with 75% of Bell's rate request granted.

15-YEAR COST SAVINGS
FOR
DIGITAL MICROWAVE PLAN II

	(millions of dollars) Case I	Case II
1. Present rates inflated 10% annually	24.0	22.7
2. 100% of rate request with inflation	27.1	26.1
3. 75% of rate request with inflation	25.9	24.8
4. 50% of rate request with inflation	24.7	23.5

NOTE: Case I = No TELPAK after 3 years.

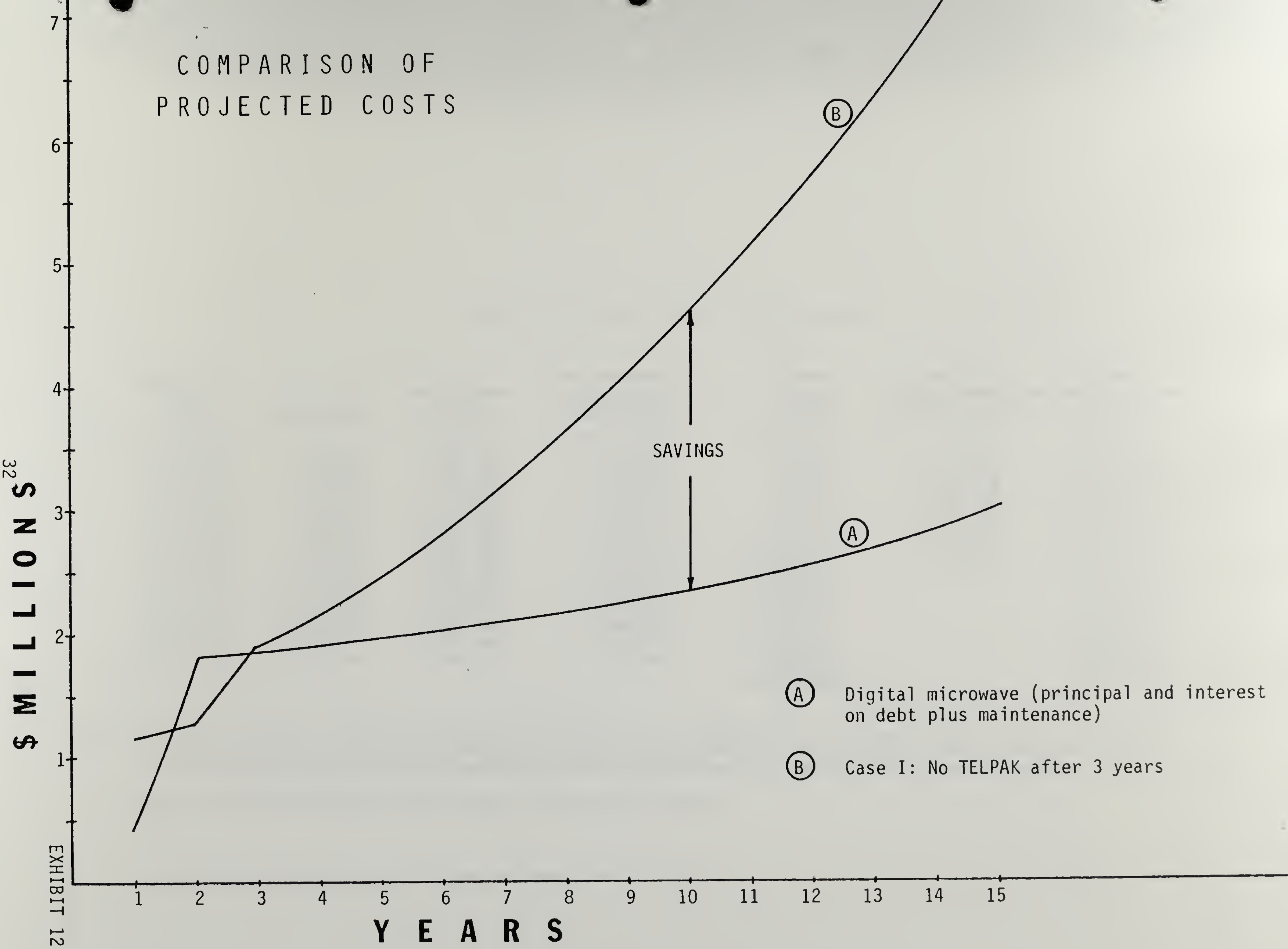
Case II = No TELPAK after 5 years.

Maintenance and retirement of debt included in this model.

-Prepared by Communications Division; November, 1982.

EXHIBIT 11

COMPARISON OF PROJECTED COSTS



Ⓐ Digital microwave (principal and interest on debt plus maintenance)

Ⓑ Case I: No TELPAK after 3 years

EXHIBIT 12

CASE I: NO TELPAK AFTER 3 YEARS (1985)

YEAR	PRINCIPAL AND INTEREST	MAINTENANCE	TOTAL COSTS INCURRED	COST AVOIDANCE BASED ON 75% RATE REQUEST	NETWORK SAVINGS (LOSS)	*SWITCH REPLACEMENT SAVINGS (LOSS)	*TOTAL TELECOMMUNICATIONS SAVINGS
1 (1984)	$ 429,765	$ 0	$ 429,765	$1,127,495	$ 697,730	$ 870,934	$1,568,664
2	1,313,130	472,000	1,785,130	1,259,955	(525,175)	1,113,888	588,713
3	1,313,130	519,200	1,832,330	1,903,097	70,767	1,383,571	1,454,338
4	1,313,130	571,120	1,884,250	2,163,526	279,276	1,682,920	1,962,196
5	1,313,130	628,232	1,941,362	2,472,638	531,276	2,015,195	2,546,471
6	1,313,130	691,055	2,004,185	2,798,824	794,639	2,383,524	3,178,163
7	1,313,130	760,160	2,073,290	3,188,237	1,114,947	2,793,422	3,908,369
8	1,313,130	836,176	2,149,306	3,628,931	1,479,625	3,247,852	4,727,477
9	1,313,130	919,793	2,232,923	4,152,871	1,919,948	3,752,274	5,672,222
10	1,313,130	1,011,772	2,324,902	4,568,158	2,243,256		2,243,256
11	1,313,130	1,112,949	2,426,079	5,024,974	2,598,895		2,598,895
12	1,313,130	1,224,243	2,537,373	5,527,471	2,990,098		2,990,098
13	1,313,130	1,346,667	2,659,797	6,080,218	3,420,421		3,420,421
14	1,313,130	1,481,333	2,794,463	6,688,240	3,893,777		3,893,777
15	1,313,130	1,629,466	2,942,596	7,357,064	4,414,468		4,414,468
					25,923,948		45,167,528

*NOTE: 1. Switch replacement savings are projected for 10 years to correspond with the average useful life of a telephone switch. The switch replacement project is at least 1 year ahead of the network project; thus, only 9 years of savings are shown since switch replacement savings projections are based on 1983 as the initial year.

2. Maintenance cost estimates begin after a 1 year warranty period.

Prepared by Communications Division; November, 1982

EXHIBIT 13

CASE II: NO TELPAK AFTER 5 YEARS (AFTER 1987)

YEAR	PRINCIPAL AND INTEREST	MAINTENANCE	TOTAL COSTS INCURRED	COST AVOIDANCE BASED ON 75% RATE REQUEST	NETWORK SAVINGS (LOSS)	SWITCH REPLACEMENT SAVINGS (LOSS)	TOTAL TELECOMMUNICATIONS SAVINGS
1 (1984)	$ 429,765	$ 0	$ 429,765	$1,127,495	$ 697,730	$ 870,934	$1,568,664
2	1,313,130	$ 472,000	1,785,130	1,259,955	(525,175)	1,113,888	588,713
3	1,313,130	519,200	1,832,330	1,408,087	(424,243)	1,383,571	959,328
4	1,313,130	571,120	1,884,250	1,575,045	(309,205)	1,682,920	1,373,715
5	1,313,130	628,232	1,941,362	2,472,368	531,006	2,015,195	2,546,201
6	1,313,130	691,055	2,004,185	2,798,824	794,639	2,383,524	3,178,163
7	1,313,130	760,160	2,073,290	3,188,237	1,114,947	2,793,422	3,908,369
8	1,313,130	836,176	2,149,306	3,628,931	1,479,625	3,247,852	4,727,477
9	1,313,130	919,793	2,232,923	4,152,871	1,919,948	3,752,274	5,672,222
10	1,313,130	1,011,772	2,324,902	4,568,158	2,243,256		2,243,256
11	1,313,130	1,112,949	2,426,079	5,024,974	2,598,895		2,598,895
12	1,313,130	1,224,243	2,537,373	5,527,471	2,990,098		2,990,098
13	1,313,130	1,346,667	2,659,797	6,080,218	3,420,421		3,420,421
14	1,313,130	1,481,333	2,794,463	6,688,240	3,893,777		3,893,777
15	1,313,130	1,629,466	2,942,596	7,357,064	4,414,468		4,414,468
					24,840,187		44,083,767

NOTE: 1. Switch replacement savings are projected for 10 years to correspond with the average useful life of a telephone switch. The switch replacement project is at least 1 year ahead of the network project; thus, only 9 years of savings are shown since switch replacement savings projections are based on 1983 as the initial year.

2. Maintenance cost estimates begin after a 1 year warranty period.

Prepared by Communications Division; November, 1982

EXHIBIT 14

CHAPTER III

LAND MOBILE RADIO

LAND MOBILE RADIO

INTRODUCTION

The State land mobile radio network is a relatively fragmented area of communications. No single agency in State government has the statutory authority and responsibility for overseeing the development of a comprehensive land mobile radio management program. In general, radio communications are managed autonomously by individual State and local agencies.

There have been, on the other hand, numerous concerns raised by the land mobile user communities about the need for certain amounts of uniformity and interaction leading to strategies for interagency communications, improved frequency assignments and coordination, sharing of radio facilities (and frequencies) and enhanced capabilities for dispatching services on local, regional, and statewide levels.

Elements of a statewide land mobile plan have been addressed in the "Montana Communications Study" and several proposals for implementing a statewide plan are included here. The need for improved radio communications was also addressed in part by the 1981 Legislature in HB 500 and HB 827 in appropriating funds for high band radio projects to be planned and implemented by the Montana Highway Patrol and Department of Highways, in cooperation with the Communications Division during the current biennium.

Elements of a land mobile radio plan which are addressed below include high band radio frequency conversion, mutual aid emergency radio frequencies, frequency coordination, and statewide land mobile transmissions.

HIGH BAND RADIO CONVERSIONS

Interagency radio communications was addressed in the Montana Communications Study as a key problem to be addressed on a statewide level. There are three basic ways to improve interagency communications. One is to make available common radio frequencies which enable each agency installing such frequencies to communicate with any other agency on the same frequency. Second, shared use of dispatching facilities and personnel would allow for enhanced interagency communications. Third, and most fundamental, is to provide for each agency to be on the same portion of the radio spectrum so that common frequencies and shared dispatching would be possible.

Currently local agencies hold licenses for 6,916 radios, while State agencies are licensed for 1,990. For local agencies, 43% are low band, and 72% of the State agency radios are low band. Table A provides an inventory of existing licensed equipment. Table B provides a breakdown by State agency, of the status of

TABLE A
INVENTORY OF LAND-MOBILE RADIO EQUIPMENT
STATE OF MONTANA and LOCAL GOVERNMENTS
March, 1982

STATE AGENCIES	LOW BAND	HIGH BAND	TOTAL
Base Stations	77 (73%)	28 (27%)	105
Vehicle Mobiles	1,221 (79%)	333 (21%)	1,554
Hand Carried Mobiles	187 (47%)	208 (53%)	391
Paging Receiver Mobiles	35 (78%)	10 (22%)	45
Control Stations	18 (90%)	2 (10%)	20
Control/Mobile Relays	-	7 (100%)	7
Mobile Relays	23 (82%)	5 (18%)	28
Repeaters	18 (95%)	1 (5%)	19
COUNTIES/MUNICIPALITIES			
Base Stations	202 (47%)	229 (53%)	431
Vehicle Mobiles	2,267 (46%)	2,668 (54%)	4,935
Hand Carried Mobiles	596 (45%)	721 (55%)	1,317
Paging Receiver Mobiles	118 (18%)	546 (82%)	664
Control Stations	5 (29%)	12 (71%)	17
Control/Mobile Relays	36 (78%)	10 (22%)	46
Mobile Relays	4 (44%)	5 (56%)	9
Repeaters	1 (10%)	9 (90%)	10

TABLE B
JUSTIFICATION: STATEWIDE HIGH BAND RADIO SYSTEM -SUPPORT DOCUMENT

STATE AGENCY	% CONVERSION COMPLETE	COST
Aeronautics	0	$11,351
Boulder School	0	7,008
Board of Crime Control	0	10,115
Commerce	100	-
Disaster & Emergency Services	100	-
DNRC	80	111,906
Eastern Montana College	100	-
Emergency Medical Service	100	-
Fire Marshal	0	21,675
Fish, Wildlife & Parks	0	248,945
Galen State Hospital	0	16,030
General Services (Administration)	0	16,637
Highway Department	13	1,561,735
Highway Patrol	16	473,559
Institutions	0	72,250
Investigations Bureau	0	52,762
Livestock	0	74,437
Montana State University	63	21,249
Montana Tech	80	8,461
Mountain View School	100	-
Northern Montana College	0	24,858
Pine Hills School	0	25,801
Revenue	0	35,908
State Prison	0	69,841
Swan River Youth Facility	0	14,301
University of Montana	75	26,670
Warm Springs	0	20,358
Worker's Comp	0	4,335
Total Materials		$2,930,192
Labor, Travel, Contracts		105,600
State Agency Total	26	$3,035,792
County/Municipal		$5,302,259
Labor, Travel, Contracts		244,000
County/Municipal Total	57	$5,546,259

high band conversion and indicates costs for converting to high band. Complete conversions would cost $3,036,000 for State agencies, and $5,546,000 local governments, or a total of $8,582,000.

Enabling interagency communications is the primary reason for converting to high band radio frequencies. There are other important technical, managerial, and legal reasons for this conversion.

Technically, high band is superior to low band. Agencies using low band frequencies experience "skip interference", a phenomenon in which radio waves are refracted back to earth from the ionosphere. This is minimized in the high band. Low band frequencies are also subject to greater interference from man-made sources, such as automobile ignitions.

Overcrowding of frequencies is much greater in the low band. This is due in part to technical limitations in the low band, but more critical is the shortage of available frequencies in the low band frequency spectrum. More frequencies are available in the high band, mobile relay is easier to accomplish, and co-channel interference (overlap between users on the same channel) is considerably less in the high band.

Land mobile radio equipment has a ten-year life. Agencies are continually replacing obsolete equipment. From a policy perspective, a decision is needed as to whether, when obsolete equipment is replaced, that equipment should be high band rather than low band. For example, over 50% of the Department of Highway's radio equipment is obsolete. Unless a deliberate decision is made to move to high band, conversion on a case by case basis will continue to be a problem. This is particularly critical for smaller local government agencies. These agencies can ill afford to replace all of their equipment at one time. Thus, they may be "locked in" to low band frequencies. State financing of a one-time conversion is one solution. Without a statewide policy decision, coupled with financial incentives, it is unlikely that complete conversion, and effective interagency communications, will occur for some time. Appendix D provides a lucid summary of the problem in proposing the current high band radio pilot project.

HIGH BAND PILOT PROJECTS

The Highway Patrol, with technical and financial assistance from the Communications Division, Department of Administration, as spelled out in a matching fund agreement, and technical assistance from the Department of Highways, Communications Bureau, is converting the Great Falls Division from the present low band system to high band. Additionally, the Patrol is including the Helena area for central dispatching capabilities.

The Highway Patrol pilot system's area of coverage is planned to encompass the general area from Browning to Chinook on the north extremities and Geyser to Lincoln on the south. Great Falls will be the central control point with dispatching capabilities out of Helena.

As requested by the 1981 Legislature, the Department of Highways has jointly participated in the Patrol's pilot program for implementing a new high band system. In addition to that pilot system, the Highway Department has developed and implemented a high band system of their own in the Great Falls district. The area of coverage is similar to that planned for the Patrol's pilot project.

Section (2) of HB 827 (L.1981) contingently appropriated to the Department of Administration, Communications Division, the sums of $42,191 for fiscal year 1982 and $53,269 for fiscal year 1983 for statewide telecommunications planning and related equipment purchases to the extent the Department receives dollar for dollar matching funds from other executive branch agencies. HB 500 (L.1981) appropriated $42,000 in FY-82 and $25,000 in FY-83 for purchase by the Highway Patrol of high band radio equipment. $98,000 was appropriated for the purchase of radio equipment by the Department of Highways.

After several problems that one would normally expect to encounter with a pilot program, the Highway Patrol's project is nearing completion. With the basic system hardware in place, the only remaining tasks involve installation of UHF control links; installation of equipment and establishment of the system necessary for Helena central dispatching capability; and a complete system operational evaluation.

The Highway Department's new high band system has been operational since March, 1982. From the first days of operation additional planning and technical system refinement has been taking place designed to result in a more complete technical plan and a more efficient operating system. No major hardware changes will be necessary; only additional mobile radio equipment has been ordered to fill out the mobile radio complement in the Great Falls Division.

A more detailed assessment of the high band pilot projects can be found in Appendix E.

STATE MUTUAL AID FREQUENCIES

Interagency communications is essential to a well coordinated handling of disasters and emergencies as well as the safety of the general public and the personnel involved in such disasters and emergencies. A series of "mutual aid" radio frequencies is a key to interagency communications, enabling each agency involved

in public safety service to communicate with any other agency.

Mutual aid frequencies are common frequencies which are to be installed in all mobile radios in addition to the agency's individual administrative and emergency channels. Those who should be installing such frequencies include local government, law enforcement, fire fighting, ambulance, and similar public safety agencies. School buses should carry a mutual aid frequency in case of emergencies possibly endangering passengers. Others possibly making use of such frequencies would include search and rescue, ski patrols, public utility vehicles and highway maintenance crews. State agencies such as the Highway Patrol, Highway Department, Brands Enforcement, Game Wardens, Emergency Medical Service Bureau, Disaster & Emergency Services, Forestry, and the Fire Marshal should maintain mutual aid frequencies. Certain federal agencies may also be desirable as users of the statewide frequencies.

Three types of mutual aid frequencies should be obtained. These are:

- Local Government Emergency Frequency
- Police Emergency Frequency
- Fire Emergency Frequency

Figure 1 illustrates which frequencies might be utilized in selected type of emergency vehicles or in hand-held portable radios. Each agency would have at least one frequency common to all other agencies, on a statewide basis. Police and Fire Emergency Frequencies enable law enforcement and fire fighting agencies to communicate with one another while leaving the local government channel free for additional use.

Communications on State emergency frequencies are designed for:

- Emergency communications between public safety agencies from various jurisdictions.

- Emergency or administrative communications by public safety vehicles when away from their normal jurisdiction.

- Command and control communications by supervisory personnel in situations where public safety agencies from multiple jurisdictions are responding to an emergency.

- Urgent administrative communications between public safety agencies where no other means of communications is readily available.

Mutual aid frequencies should be administered through a central agency in order to assure the orderly assignment of use to eligible users and establish a control over the appropriate types of use of these frequencies as well as to establish guidelines

FIGURE 1

ELIGIBILITY FOR MUTUAL AID RADIO FREQUENCIES IN SELECTED AGENCY RADIOS

	Local Government Emergency Frequency	Police Emergency Frequency	Fire Emergency Frequency
County Sheriff	x	x	x*
City Police	x	x	
Fire Department	x		x
Ambulance	x		
Road Crew	x		
School Bus	x		
Highway Patrol	x	x	
Game Warden	x	x	
Brand Inspector	x	x	
Fire Marshal	x		x
Civil Defense Coordinator	x		
Disaster & Emergency Services	x		
Emergency Medical Services	x		
State Forestry	x		x
Local Utility	x		
FBI	x	x	
U.S. Forest Service	x		x

* Where Sheriff serves as Fire Chief

for their use and protect against abuse of them. At the present time, mutual aid frequencies are administered by the Department of Administration. An advisory committee, such as that contemplated for overall State frequency coordination, discussed below, should serve to assist the Director of the Department of Administration in maximizing the effective and efficient use of these frequencies. The Department of Administration serves a useful purpose in this regard since it would not be a principal user of these frequencies. The advisory body, however, should be constituted of principal users in order to gain their insight and to alert the Department of Administration to potential or existing problems.

The State of Montana would serve as the licensee for each frequency. Individual agencies using mutual aid frequencies would enter into cooperative agreements with the State (through the Department of Administration) which would be based on standards of eligibility and use as well as concurrence with adherence to Federal Communications Commission regulations governing emergency mutual aid frequencies. (See Appendix F).

Consistent with orderly development of statewide radio communications, certain requirements need to be established for private vendors of land mobile radio equipment. In order to adequately control the use of these frequencies, cooperating agencies should inform the State of the location and use of frequencies in mobile radios, and should likewise notify the State when use of a frequency is abandoned. The State should also retain, as the licensee, the right to confiscate radio crystals (which are necessary components of radios enabling use of a particular frequency) upon consistent and flagrant abuse of the mutual aid frequencies. Consequently legislation should be designed to restrict private vendors from sale of radio crystals to agencies not participating in cooperative agreements for use of mutual aid frequencies.

The Local Government Emergency Frequency has been licensed to the State. This frequency, 153.905 MHz, will be made available to state and local agencies within the next several months based on administrative regulations prepared by the Department of Administration.

The Police Emergency Frequency, 155.475 MHz, is currently undergoing Canadian review. Although this frequency has been identified in FCC Rules as a nationwide police emergency frequency, certain adjacent channel interference is feared by users in British Columbia, Alberta, and Saskatchewan. Negotiations with these users is contemplated in order to secure 155.475 MHz. Another police emergency frequency could be obtained. However, since the states of North Dakota, Washington and Idaho are also using 155.475 MHz, there are interstate communications advantages to acquiring this frequency.

A Fire Emergency Frequency is to be identified in 1983. Coordination of overall fire frequencies for Montana is being

transferred from a coordinator in Oregon to the Montana Fire Marshal. Once this transfer is complete, that frequency will be determined and managed.

Establishment of mutual aid emergency frequencies is an important step in developing a coherent statewide radio communications network and in enabling an effective response among cooperating agencies to disasters and emergencies.

FREQUENCY COORDINATION

The "Montana Communications Study" observed, "Frequency coordination between statewide users is poor. There is a need for better spectrum management in order to avoid overuse and overcrowding of frequencies, particularly since more and more users are in need of new frequencies each year".

Frequency coordination is a major issue, and often a controversial one. Jurisdictions using land mobile radio service are highly protective of their ability to use the airwaves while at the same time resent interference which may be caused by users adjacent to them.

The role of State government in frequency coordination is limited in several respects. First, responsibility for coordination is assigned by the Federal Communications Commission (FCC) to four different private non-profit associations presumably reflecting interests and concerns of the user community, i.e., police, fire, highway operations, foresters, and general government. These associations designate regional or state members to serve as coordinators. As a rule, except for forestry conservation, each State has a coordinator who is normally part of State government, but this varies, as will be noted in discussing fire frequency coordination below. Second, Montana appears to have no firm policy or statutory guidelines defining frequency coordination responsibilities. Third, the role of coordination is limited to an advisory function which can be a strong or weak role depending upon acceptance of coordination advice by the FCC and the user communities. This role is also dependent upon the degree of sophistication with which frequency coordination is approached. One of the methods for improving frequency coordination, for example, is the development and acceptance of a State frequency coordination plan.

There are six radio services in the Public Safety Radio Service, that part of the frequency spectrum designated by the FCC for use by State and local governmental agencies. Any application for an FCC radio license in any of these services, with the exception of the Special Emergency Radio Service, requires evidence of frequency coordination prior to a license being granted by the FCC. These radio services and the responsibility for frequency coordination are as follows:

RADIO SERVICE	COORDINATION RESPONSIBILITY
Police Radio Service	Associated Public Safety Communications Officers, Inc. (APCO)
Fire Radio Service	International Municipal Signal Association (IMSA)
Highway Maintenance Radio Service	American Association of State Highway and Transportation Officials (AASHTO)
Forestry Conservation Radio Service	Forestry Conservation Communications Association (FCCA)
Local Government Radio Service	Any of the above listed Associations
Special Emergency Radio Service	None

The APCO coordinator is located in the Department of Administration's Communications Division. Users of the Police Radio Service include county sheriffs, municipal police departments, the Montana Highway Patrol, game wardens, brand inspectors, and others engaged in law enforcement functions.

The Fire Radio Service has been coordinated until 1982 by a member of IMSA located in the State of Oregon. However, since this member has retired, the Montana Fire Marshal Bureau has been approved by IMSA to assume coordination for Montana users who include local firefighting companies and departments and the Fire Marshal Bureau, Department of Justice.

Highway Maintenance Radio Service coordination is managed by the Department of Highways Communicatons Bureau. Users besides the Department of Highways include county and municipal road departments and public works departments.

Forestry Conservation Radio Service coordination is organized on a district basis. The coordinator for the northwest district is located in the State of Oregon, although the Department of State Lands' Forestry Division provides liaison for Montana with the FCCA district coordinator.

Any of the above coordinators may recommend frequencies in the Local Government Radio Service, and the FCC requires coordination among the various associations on a license application for this service. In Montana, virtually all coordination requests for the Local Government Radio Service are received initially by the APCO coordinator. Users for these frequencies can include any of

those users in the above services and also includes such users as Disaster & Emergency Services, Department of Military Affairs.

Applications for licenses in the Special Emergency Radio Service do not require coordination except where frequencies in this part of the spectrum are adjacent to other services. Users eligible for these frequencies include search and rescue, ambulances, school buses, and a variety of public safety-related entities. A recent policy decision by the FCC allows the APCO coordinator to review frequencies which may interfere with other public safety services.

The coordination function basically involves review of frequencies for which application has been made in order to determine potential interference because of nearby users in adjacent geographic areas on the same, or adjacent radio frequencies. If a base station is within 75 miles of another state, coordination must also include consideration by the adjacent state's coordinators. Montana also must receive Canadian review for applications close to the Canadian border.

In order to strengthen the coordination process, a policy needs to be established defining the responsibilities the State wishes to assume in this area. Legislation should be proposed to identify responsibility for coordination and to also provide for resolving coordination problems and delineating a State frequency usage plan. The elements of such a plan are identified in Appendix G.

TOWARD A STATEWIDE LAND MOBILE NETWORK

Planning activities during 1982 have been aimed at development of a coherent statewide land mobile network. Elements of that network described above include conversion of State and local radios to the high band frequencies, high band pilot projects, mutual aid frequencies and frequency coordination.

Two major networks are also being prepared. These are the statewide transmission network described in detail earlier in this report, and the "State Emergency Capability Using Radio Effectively" (SECURE) network. SECURE is described in Appendix H. Because it is not available on a daily basis to all state and local agencies, SECURE is considered as a complementary component of statewide radio communications.

The overall goal of these planning activities is to update and modernize statewide radio communications, enabling interagency communications and rapid responses to disasters and emergencies while minimizing the fragmentation in this area of State communications.

AN ERA

OF

TELECOMMUNICATIONS OPPORTUNITIES

AN ERA OF TELECOMMUNICATIONS OPPORTUNITIES

The era of the 1980's will probably be known as the era of functional integration of communications, of computing, and of data and word processing.

This integration is being driven by five major technologies: large scale integrated circuits; digital communications; high-level communications software; satellite communications; and lightwave technology. It is also being driven by deregulation of the telephone industry.

These technologies support the concept of integrated networks - systems which enable greater depth and uses of communications than every before. The new goal of networking is to provide as much connectivity between a diverse range of devices as possible. For example, an integrated information processing system which is a hybrid system consists of a voice and data PBX, which provides telephone service and limited data terminal service. It will provide word processing, electronic filing, data processing, terminals, minicomputers, imaging, teleconferencing, facsimile and electronic mail.

The multifunction work station will provide the knowledge worker with data processing, word processing, communications and personal support. At a given terminal or work location, an individual worker will be able to perform all of these functions to whatever degree the worker is provided with the network.

In the past the emphasis has been on the secretary and augmenting the functions of paperwork flowing from the secretary's desk. We have just begun to tap the potential for exploiting the technology in increasing the productivity of the whole system.

The interconnect system, the switch-and-access network, and the application of digital microwave equipment and lightwave equipment, and new digital PBXs, will make it possible to own networks rather than using the classical public interconnect system, providing one of the major opportunities for cost savings in networking.

A decentralized environment, such as we are dealing with when analyzing the communications requirements for the State of Montana, requires a unique type of networking. For a truly integrated network, there must ultimately be the capability to enable access to a statewide network of all 56 Montana counties. Smaller, local area networks will be required to integrate communications among several users in a single community or an urbanized county.

The communications planning initiated in 1980 barely scratches the surface of the potential for large-scale networking. Part of the reason for this is that planning in communications is a highly dynamic enterprise due both to the available resources

which can be devoted to communications investment and to the explosive and constant changes in available technologies. Proposals considered in this study provide the essential backbone for a future fully integrated network.